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ALSIKE CLOVER



ALSIKE CLOVER is most at home in northern latitudes or at high altitudes. It thrives best in a cool, moist climate.

In the Ohio Valley alsike clover is especially adapted to low, wet, fertile land. On such land it will yield heavy crops of first-class hay and will make more than one crop in a season.

This crop will grow on "sour" land on which red clover will not thrive. Where it is not possible to apply lime and so insure a stand of red clover, alsike clover may be used.

Mixed with red clover on uplands, alsike clover insures a stand on spots where red clover does not catch.

Alsike clover is used mostly in mixtures with timothy or other grasses. In such mixtures it improves the hay and increases the yield. The grasses serve to support the clover and make it easier to cut and cure.

Alsike clover will endure overflow that would kill most crops. It has been known to grow a year in water-soaked and water-covered soil and make a heavy growth. In the South it is recommended for creek bottoms and other wet lands.

It is a good pasture plant, often remaining in a permanent pasture for many years.

It is a good clover to seed in swales or on wet, natural meadows. It volunteers readily and will spread in such places.

Its disadvantages are that—

(1) On uplands alsike clover grows short and does not make a mass of growth equal to that of red clover.

(2) Alsike clover makes no second crop except on low, rich land.

(3) On uplands the pasturage after cutting for hay or a seed crop is too small to be useful.

(4) There appears to be some danger to horses and mules of a little-known disease said to result from eating alsike clover.

Contribution from the Bureau of Plant Industry.

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Washington, D. C.

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ALSIKE CLOVER.

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CONTENTS.

	Page.		Page.
Utility of alsike clover-----	3	Uses -----	9
History of alsike clover-----	3	Second crop of alsike clover-----	21
Botanical characters of the plant-----	4	Alsike clover as a volunteer crop-----	21
Climatic adaptation and distribution-----	5	Diseases and insect enemies-----	22
Soil and moisture requirements-----	5	Some harmful effects of alsike clover-----	23
Seed, seedling, and companion crops-----	6	Seed production-----	23
Inoculation-----	8		

UTILITY OF ALSIKE CLOVER.

CLOVER is a basic crop in the agriculture of the greater part of the Northeastern States and as far west as the Great Plains. In this region red clover is the standard leguminous rotation crop, but there are soils and situations in which red clover will not thrive. Low, wet land and soils that are low in lime content or have been run down by long and unwise cultivation are unsuited to red clover. On many of these soils alsike clover can well replace it. Alsike clover succeeds better than red clover on wet land, and when mixed with red clover on uplands it will insure against failure from lack of lime or other unfavorable soil condition. When red-clover seed is extremely high in price alsike clover can be substituted on many soils. The seed is often cheaper, and being smaller than that of red clover less is required to the acre.

HISTORY OF ALSIKE CLOVER.

Alsike clover is a native of northern Europe and is known also as Swedish or hybrid clover. The names alsike and Swedish refer to the locality and to the country from which this plant was introduced into England, while the name "hybrid clover" was given it because it was thought to be a cross between red and white clovers. It was named *Trifolium hybridum* by Linnaeus in 1753, as he too believed



FIG. 1.—Alsike-clover plant, showing the habit of flowering; the oldest flower heads below, the youngest coming out above. The older flowers are reflexed; the younger ones erect.

in the hybrid origin of the species. In its native home it has been cultivated since early in the tenth century, but it was not until about 1834 that seed was brought to England, and five years later the editors of the *New Genesee Farmer*, of Rochester, N. Y., brought some seed to this country and distributed it to the readers of that paper. In 1854 a distribution was made by the United States Patent Office. Doubtless there were other importations. Emigrants from northern Europe came to this country, and some of them are known to have brought alsike-clover seed with them. An Austrian named Walenta, who settled in Winneshiek County, Iowa, in 1854, brought seed of alsike clover with him; probably other settlers did the same.

BOTANICAL CHARACTERS OF THE PLANT.

Alsike clover is perennial, though usually treated agriculturally as a biennial. Many smooth stalks come from the crown, and they bear smooth leaves, each with three leaflets, and heads of flowers partly pink and partly white. In many heads the flowers are all white; in others, all pink. As the flowers fade they bend back and hang down. (Fig. 1.) Under favorable conditions the stalks grow 3 to 5 feet long,

but on drier soil they may not become more than 18 inches in height. Alsike differs from red clover in its habit of growth. In red clover the main axis terminates in a flower and thus limits the growth. Branches arise from the leaf axils and these in turn are terminated by flowers. In alsike clover the main axis keeps on growing. Single flower-bearing branches, each with one or more flower heads, arise successively from each leaf axil. (Fig. 1.) The leafy branches may in turn keep on growing, with flower heads or smaller branches in the axil of each leaf. Thus, in red clover the terminal flower head of the main stem or of a branch is the oldest on the plant or branch, while in alsike clover the terminal flower heads are the last formed, the older ones being successively lower on the stem. While in red clover the flower heads are not borne at exactly the same height from the ground, there is no great difference between the levels to which the various flower heads rise. In alsike clover the stem, however long, may bear flower heads along its entire length. This character is important not only from the standpoint of seed production but in making alsike clover fit to cut for hay over a longer period than in the case of red clover.

CLIMATIC ADAPTATION AND DISTRIBUTION.

Alsike clover prefers a cool climate. Its home on the Scandinavian Peninsula shows that it is fitted to withstand cold weather, and this is confirmed by experience in this country. This clover withstands severe winters better than red clover, and it thrives best where the summers are cool. In the South it is less successful, thriving only where an abundance of moisture enables it to overcome the injurious effect of the warm summers. The geographical distribution of this clover in the United States is roughly that of the timothy-clover area. (Fig. 2.) Alsike clover is very generally grown in the area north of the Ohio and Potomac Rivers and as far west as the Dakota-Minnesota boundary. It also is grown in Idaho and on the Pacific coast of Washington and Oregon. In the South alsike clover is grown to a limited extent in Virginia, Kentucky, Tennessee, and Missouri, but in other Southern States it is almost unknown.

SOIL AND MOISTURE REQUIREMENTS.

Alsike clover prefers a rather heavy silt or clay soil with plenty of moisture. Although it will thrive on good loams, it usually does not do well on dry, sandy, or gravelly soils. A rich, moist bottom soil suits it best, and on such soils it will grow luxuriantly. It responds to an application of lime, but is not as sensitive to acidity as red clover, and can be successfully grown on many wet, cold, and "sour" soils on which red clover does not succeed.

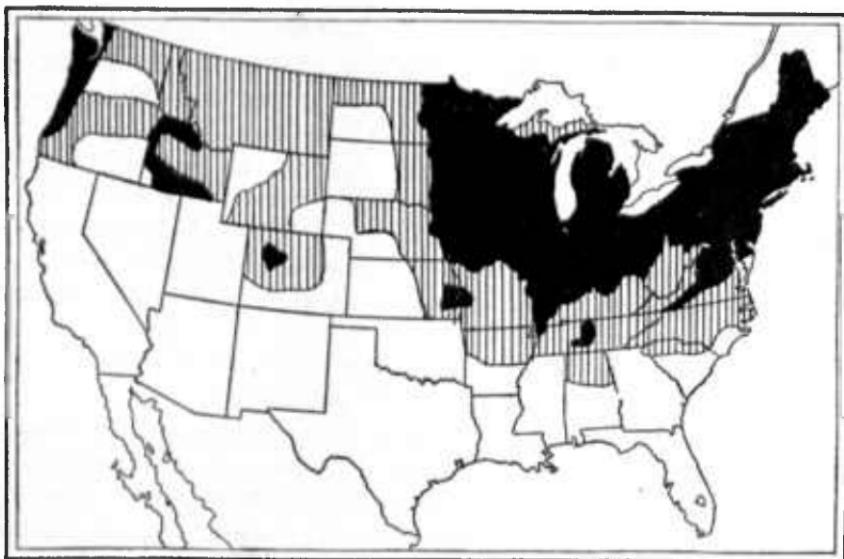


FIG. 2.—Outline map of the United States, showing roughly the area in which alsike clover is grown. The black area shows where alsike clover is more or less regularly used as a forage or seed crop; the hatched area, where it is rarely grown or only in special places.

SEED, SEEDING, AND COMPANION CROPS.

The seeds of alsike clover are small, there being 700,000 to the pound. This is more than twice as many as there are of red-clover seed in a pound. The color of the seed is green of various shades mixed with yellow. With age the color becomes darker, and very old seed may be brownish green. Seed of the last sort is not fit for planting.

In the Northern States the seed is usually sown in early spring, though in many places in late summer, for instance in New Jersey, where clover seeding often follows early potatoes or cabbage in July and August. In Indiana and Ohio seed is sometimes sown in corn at the last working, but there is always considerable risk connected with this, and the practice can not be recommended save in exceptional circumstances. Seeding in July with buckwheat is successfully practiced in southern Michigan, but this method is not general. If for any reason a stand is not secured from spring seeding, the stubble field may be disked and clover seeded in late July or August, with a fair chance of success unless a severe drought should occur. In those parts of the South where alsike clover is used it is commonly seeded in the fall.

When sown in spring the seed is either broadcasted on winter grain or it is sown with spring grain. Seeding on winter grain is usually done as it is with red clover, the seed being broadcasted when the ground is checked by frosts or else on a late snowfall, so that the

seed may be carried into the ground with the thawing of the snow. When seeded with spring-sown grain the seed bed is in good shape and the clover can be most advantageously put in with a drill.

There being, as stated, some 700,000 seeds in a pound, every pound of seed if evenly scattered will put about 16 seeds on every square foot of an acre. If 6 pounds of seed are evenly scattered there will be one seed on every $1\frac{1}{2}$ square inches. When 5 pounds of seed are drilled there will be an average of one seed every half an inch in the drill with the rows 4 inches apart. These quantities of seed will make heavy stands if not more than half the seeds finally produce plants. While thicker seeding may help to choke out weeds, it must not be forgotten that with too thick seeding a certain percentage of clover plants will also be smothered out and much seed will be wasted.

When broadcasted on winter grain, rather more seed should be used than when drilled, as much of it will be wasted. When the soil is dry enough it is good practice to harrow in the broadcasted seed. This may be done with a spring-tooth weeder or with a spike-tooth harrow having the teeth set back. Harrowing will rather benefit the grain and will make a stand of clover more certain. The use of a drill wherever possible is urged. It will save seed, and the seed being put into the ground at a proper and uniform depth the seedlings will have a better chance to grow and the stand will be better. Care should be taken not to seed too deeply. On heavy soil one-half inch and on light soil an inch is deep enough. On poor or on run-down soil care is especially important, and broadcasting the seed on such soil when checked by frost or on snow is too risky to be recommended; it should be drilled or harrowed in. For success a good seed bed is important. It should be firm, but fine on top, so that the young plants may be well supplied with moisture.

While the methods to be employed to get a good stand of alsike clover will differ with the locality and will depend on soil and climate, the principles involved are simple and can be briefly stated. To grow the seed needs warmth, air, and moisture, and to thrive the plants must have food, light, warmth, air, and moisture. Seed may be sown so early that the young seedlings which have started during some early warm days are killed by a late frost, but this does not happen often. A more frequent cause of the loss of a seeding is dry or hot weather after grain harvest. Before grain harvest the young clover plants have to compete with the grain for moisture, and the grain also shades the clover, which keeps it weak. While the grain tends to keep down the weeds and so serves a useful purpose, it also keeps down the clover, and when the grain crop is heavy the clover may easily be smothered out along with the weeds. When the season is dry, the grain gets the larger share of the moisture and the

clover suffers in severe cases so badly that the young plants die. Loss from drought is naturally greater on sandy soils and on run-down soils, as neither of these contains much organic matter. Organic matter helps a soil to hold moisture, and soils with little organic matter tend to lose moisture rapidly. If clover, then, is seeded in spring on a run-down soil, on winter grain or with oats, the grain will get what moisture there is, and in a dry season the result may be the failure of the clover to make a stand. On rich or moist soils or in a wet season there will be moisture enough for both grain and clover.

It remains, then, for each farmer to decide for himself whether on a piece of run-down land he wants to get a crop of grain or one of clover. For the good of the land, of course, the clover should have first consideration, and the chances for the clover will be much better with a light than with a heavy grain crop. It may not be advisable to omit the companion grain crop entirely, but the seeding should be reduced, or a companion crop should be selected that is least hard on the clover. As a winter grain rye is usually better than wheat, since it does not shade the ground so much and comes off earlier. If oats are used, an early variety is better than a late one. Further, it is often better to sow 1 bushel of oats than to sow 2, and, lastly, if the season turns dry it is better to eat the grain in the dough stage for hay than to allow it to ripen for grain. Often if the oats are cut early for hay a light cutting of alsike-clover hay may be taken the same year. The object should always be to leave sufficient moisture for the young clover plants, especially at the critical time just after the removal of the companion crop.

Alsike clover is seldom seeded alone unless a seed crop is wanted. Usually it is seeded with timothy, with red clover, or with both. A common practice is to sow timothy in the fall and to sow alsike alone or alsike and red clover in the spring. Rather more seed of timothy and red clover than of alsike clover is then used, a common formula being alsike clover, 1 part; red clover, 1 to 2 parts; timothy, 2 to 3 parts. The same ratios usually obtain when alsike clover is seeded with timothy alone or with red clover alone, 8 to 12 pounds of such a mixture per acre being generally used.

INOCULATION.

In order to use the nitrogen of the air, alsike clover, as is the case with all legumes, must be infected with the appropriate nodule-forming bacteria. Fortunately, these are so widely distributed that they are present on most clover land. On new land they may be wanting, especially on burned-over land and on newly drained marsh land. In such cases the seed should be inoculated. This may be done by scattering soil from a field on which white, red, alsike,

or crimson clover has made a good growth or by applying a pure culture of the proper bacteria to the seed. If soil is used, it should be spread on a cloudy day or in the evening and immediately harrowed in, as the bacteria are killed by sunlight. Pure cultures should be used according to the directions furnished with them. An important point is to keep the seed in the shade while drying.

USES.

ALSIKE CLOVER AS A HAY CROP.

Alsike clover makes the best quality of hay; better, indeed, than red clover, though where conditions are favorable for red clover, the latter will yield more hay than alsike clover. In 1916 a bunch of alsike-clover hay took the first prize at the Iowa State Fair (fig. 3). Chemical analysis shows that, so far as the composition of the hay is concerned, there is not much difference between red clover and alsike clover.

Table I¹ gives the quantities of digestible food materials in 100 pounds of hay.

TABLE 1.—*Quantities of digestible materials in 100 pounds of alsike-clover and red-clover hay.*

Kind of hay.	Dry matter.	Protein.	Carbohydrates.	Fat.	Fuel value (calor. es).
Red clover.....	84.7	7.38	38.15	1.81	92,324
Alsike clover.....	90.3	8.15	41.70	1.36	98,460

From this table it will be seen that in equal quantities of alsike and red-clover hay the alsike clover contains more digestible protein and has a higher fuel value than the red-clover hay. In certain tests of the feeding value of hays carried on by the Montana Agricultural Experiment Station in 1911 it was found that sheep fed on alsike clover made 1 pound of gain for 6.32 pounds of hay consumed and those fed on red clover 1 pound of gain for 6.43 pounds, while those fed on alfalfa made 1 pound for 6.58 pounds of hay consumed. While the advocates of alsike clover do not contend that it makes a better hay than alfalfa, good alsike-clover hay is certainly equal to the best and is better than most hays, and there are soils and situations where this clover will outyield any other crop of its kind. Then, too, the alsike clover, being a smooth plant, makes a cleaner, less dusty hay than red clover.

Alsike clover has some advantage, moreover, in being finer stemmed. There is not so much waste as in red clover, as stock clean

¹ From Farmers' Bulletin 22, United States Department of Agriculture.



FIG. 3.—Well-cured alsike clover makes hay equal to any. The bunch of hay shown took the first prize at the Iowa State Fair.

as well as the inference which may be drawn from its chemical composition, as shown in Table I, does not support such a view.

Because of its weak, slender stems, alsike clover usually should not be seeded alone for hay. When in a pure stand, especially on moist or wet land, the stems mat together and the plants are difficult to ent. Sown with timothy or with red clover, the weaker stems of alsike clover are supported by the more upright ones of the red clover and of the timothy, and the alsike clover acts as a filler, making the stand thicker below and thus adding materially to the weight of hay cut. Alsike hay is greener than that of red clover, and unless the stand is extremely thick it cures more readily. When the stand is thick, as it is apt to be on low, rich land, it may be necessary to do some handwork in turning it, in addition to using a tedder. A successful alsike grower in Colorado allows the cut clover to lie in the

it up better. Many dairymen consider it the best of hay, and it is noticeably most popular in the Northeastern and New England States, where it thrives best and is best known. Unfortunately, except in the Montana trial already quoted, there is no record of any definite tests having been made with alsike-clover hay as compared with red-clover hay. This is possibly owing to the fact that alsike clover for hay is so rarely grown alone. Some farmers claim that the hay has not as much feeding value as that of red clover, but the weight of opinion

sun for $1\frac{1}{2}$ days, then turns it in small windrows, and puts it in the stack in the afternoon of the third day. This grower gets heavy yields on sandy land under irrigation. It is important in handling this clover not to let it get too dry, because then the leaves and heads break off and the value of the hay is much reduced. It has been noted that alsike clover when cut will endure without serious injury a wetting that would ruin red clover.

ALSIKE CLOVER WITH RED CLOVER OR TIMOTHY.

Alsike clover is seldom grown alone for hay. Except when grown especially for the seed crop it is almost always mixed with either red clover or timothy, mostly the latter, or even more often with red clover and timothy. The use of alsike clover in mixtures has increased of late years wherever it has been difficult to get a stand of red clover. At present in many of the Northern States alsike clover is sown on probably 75 per cent of the clover and timothy acreage. When equal parts of alsike and red clover are seeded there is more alsike than red clover in the stand; when the quantity of alsike is half that of red clover, the quantity of each in the stand is about the same.

Timothy and alsike clover together make an exceptionally good hay. The alsike clover cures to the same color as timothy, and the timothy helps to keep the clover from packing when cut, so that it is more airy in the swath and cures better and quicker than pure alsike. With good weather conditions such mixed hay will be ready to rake and stack about a day after cutting. On rich, moist land it is especially important that the alsike clover be seeded with timothy or with some other grass, such as redtop, as on such land the clover grows very rank, with long stems that mat together when grown alone and lie on the moist surface of the soil. Under such conditions the lower leaves decay and some of the flower and seed heads also partly decay. This moldy, partly decayed vegetable matter may get with the hay or be eaten in the pasture. Though there is no direct evidence for the view, it is not impossible that some of the bad effects reported as having followed pasturing on alsike clover may have been due to moldy feed. This may be avoided by seeding the alsike clover with one-half or one-third timothy to hold it up. In many sections of the United States mixed timothy and alsike hay sells for the same price as pure timothy, provided the proportion of alsike is not more than 12 to 15 per cent. An equal quantity of red-clover hay would discolor the whole and reduce the grade.

Rate of seeding in mixture with red clover and timothy.—The rates of seeding mixtures of alsike with red clover and timothy, either

or both, vary in different sections. Table II gives some of the formulas that are in use in the States named.

TABLE II.—*Proportions of alsike clover, red clover, and timothy used in mixtures in various States.*

State.	Rates of seeding per acre (pounds).			Remarks.
	Alslike clover.	Red clover.	Timo- thy.	
Illinois.....	2	10	5	
Do.....	4	4	4	
Do.....	4	4	8	
Do.....	2	6	4	
Indiana.....	2	2	4	
Do.....	2	2	2	
Maine.....	4-6	-----	1	
Do.....	7	8	8	
Do.....	6	6	20	
Do.....	15	15	-----	Preparation for potatoes.
Maryland.....	5	5	20	
Michigan.....	6	6	10	
Do.....	1	-----	9	
Do.....	4	8	-----	
Do.....	4	12	-----	
Do.....	6	6	-----	
Do.....	4	8	8	
Minnesota.....	1	4	3	
Do.....	5	5	5	
Do.....	5	-----	10	
Do.....	7	4	4	
New York.....	4	-----	12-14	This is a common mixture.
Do.....	2-4	3-4	9-12	
Do.....	2	6	16	
Do.....	4	8	8	
Do.....	6	-----	10	
Do.....	4	4	12	
Do.....	2	4-6	11	
Pennsylvania.....	6	6	16	Sow 24 pounds of mixture per acre.
Do.....	8	-----	8	
Do.....	4	12	-----	
Vermont.....	4	5	-----	
Do.....	4	5	15	
Wisconsin.....	8	-----	10	
Do.....	2	6-8	2	
Do.....	4	4	4	
Do.....	6	1	1	

Time to cut in mixture with red clover and timothy.—The best time to cut alsike clover for hay is when it is in full bloom. (Fig. 4.) It blooms irregularly, and when the field as a whole is in full bloom there will be many heads with seed which is already ripe. Fortunately, the fine stems of alsike clover do not get hard as quickly as the stems of red clover. They keep on growing and blooming as the lower flower heads mature, and consequently good hay may be made within a range of several days. When a grower wants seed as well as hay the field may be allowed to become a little more nearly mature. Both good hay and a fair seed crop may then be secured. When grown in mixture, especially with timothy (fig. 5), this characteristic of remaining good for some days is especially valuable. There is a wide range of expressed opinion as to whether alsike clover ripens for hay at the same time as timothy. The United States Department of Agriculture has on file many reports, among which some farmers in

the Central States claim that it ripens with timothy and others that it ripens before timothy. This difference is perhaps due to a variation in the conception as to the time when the clover is in the best stage to cut. If it is to be cut before any heads are ripe it will doubtless be ready before timothy, but it will also remain in good condition to cut after a few of the lower heads contain ripe seeds and in that case usually will be ready for harvest with timothy. It is not desirable, however, to allow alsike clover to get too ripe, as the presence of much ripe seed is said to be one cause of the slobbering of horses fed on the hay. When seeded with red clover the hay will be at its



FIG. 4.—Alsike clover in New York, ready to cut.

best if cut when the red clover is in full bloom. Alsike when sown with red clover improves the quality of the hay, besides thickening up the lower parts of the stand and thus adding materially to the yield. A mixture of alsike and red clovers is said to yield a greater weight of hay than either variety alone.

ALSIKE CLOVER IN OTHER MIXTURES.

Besides the mixture of alsike clover, red clover, and timothy, which is by far the most common one in use, various other mixtures are recommended for different situations and sections. The Illinois Agricultural Experiment Station suggests for pastures sweet clover, 4 pounds; alsike or red clover, 4 pounds; timothy, 2 pounds. A common mixture is alsike clover, timothy, and redtop, this mixture being used on rather "sour" soils on which the timothy fails to last long. Kentucky bluegrass is sometimes added to the mixture, especially when it is designed to pasture the meadow after a year or two.

A mixture of 10 pounds of redtop and 5 pounds of alsike is especially valuable for its ability to produce profitable yields on heavy, wet land. It is of most importance for hay, although the aftergrowth will also furnish considerable pasturage. More elaborate mixtures, used to some extent, are mentioned below.

The Ohio Agricultural Experiment Station suggests for the northeastern part of the State 5 pounds of red clover and 3 pounds each of alfalfa and alsike clover. In many places the clover and alfalfa are seeded together. In western New York the writer has seen such a field when the alsike clover had made a heavy growth and no alfalfa plants could be found. (Fig. 6.) However, after the clover was cut the alfalfa came on well and made a good stand.



FIG. 5.—Alsike clover and timothy, ready to cut.

In Montana and Minnesota alsike clover is sometimes seeded with brome-grass for pasture.

The Idaho Agricultural Experiment Station recommends the following for irrigated pastures in that State: Redtop, 8 pounds; timothy, 8 pounds; meadow fescue, 6 pounds; and alsike clover, 4 pounds.

On the Pacific coast rye-grass forms part of a mixture with alsike clover. In Humboldt County, Calif., a mixture of 4 pounds each of alsike clover, red clover, timothy, orchard grass, and rye-grass is used.

In Virginia a mixture of alsike clover with orchard grass, tall meadow oat-grass, redtop, and white clover is said to give good results.

In Missouri certain farmers think highly of a mixture consisting of 5 pounds each of alfalfa, meadow fescue, and orchard grass with

3 pounds of alsike and 2 pounds of timothy. This can be pastured till June 1 and later cut for hay. This mixture is seeded with 1 bushel of oats as a companion crop and is pronounced a success. Another favorite mixture in the South is orchard grass, 10 pounds; perennial rye-grass, 5 pounds; redtop, 3 pounds; and alsike clover, 4 pounds. The Arlington mixture of 20 pounds of tall oat-grass, 10 pounds of orchard grass, and 4 pounds of alsike clover has been successfully used as a mixture for hay in sections south of the timothy region.

The Tennessee Agricultural Experiment Station has suggested a mixture of 5 pounds each of orchard grass and tall meadow oat-grass and 4 pounds each of redtop and alsike clover.

The seeding of alsike clover with orchard grass is not uncommon in the South, especially in Kentucky. In Franklin County, Ky., orchard-grass seed is harvested, and there alsike clover is frequently seeded with the orchard grass. If all hay is wanted the entire crop is cut when the clover is in full bloom. At this time the orchard-grass seed is not yet ripe and the grass is tender, making an excellent hay. In that section alsike clover gets overripe before timothy is ready to cut, but orchard grass replaces the timothy very satisfactorily. When the orchard grass is wanted for seed it may be cut high above the clover with a binder. After the little shocks are set in rows, four or five together, the mowers may follow and cut a fine lot of hay consisting of alsike clover and the lower parts of orchard grass.



FIG. 6.—A heavy growth of alsike clover in New York. The alfalfa in this field came on later to a good stand.

ALSIKE CLOVER AS A PASTURE PLANT.

Alsike clover is especially suited for use in pasture mixtures. Its vigorous growth enables it to hold its own against the competition of other plants, and its persistency in seeding provides for its continuance. For permanent pasture on low or "sour" land alsike clover is especially valuable and may be used alone or, better, with redtop. In the South, where this clover is little used for hay, it has proved valuable as a part of the permanent pasture mixture on bottom lands. The many creek and river bottoms in the South which are hard to work because too wet to plow in spring or because of occasional floods, could be seeded profitably to a mixture of alsike clover and redtop. Where the clover has been used in this way it has given a good account of itself, having been grazed the entire summer without damage.

In the North, alsike clover is commonly seeded with timothy and red clover for pasture as well as for hay. While in the course of a rotation the fields are usually plowed after 3 to 5 years, cases are known of alsike clover having been pastured over 12 and as many as 30 years. When it is grazed or cut early it at once sends out new branches, and these will produce flowers and mature seed when not more than a few inches long; in this way the ground is constantly full of seed and the pasture keeps in good shape. Alsike clover in pasture is also more hardy than red clover; it will withstand more trampling than red clover and does not heave out as readily. In Missouri it has been found especially valuable on rocky hillsides and on flinty land; there, where red clover will not thrive alsike clover mixed with orchard grass makes good pasture. This quality of enduring close grazing and trampling also makes it valuable for hog pasture. In Nebraska, a mixture of brome-grass and orchard grass with alsike clover, the latter constituting 75 per cent of the mixture, is used and highly regarded as hog pasture and is said to be next to alfalfa in quality. If the pasture is intended to be permanent it must not be grazed too closely. The plants should have a chance to make seed, as the old roots will die in two or three years and the continuance of the pasture will depend on the seed that has fallen.

Besides its use in permanent pastures, meadows containing alsike clover are pastured before or after haying, and fields intended for seed are often pastured until late May or early June. On rich land alsike clover tends to grow very long, with few branches. If such a field is pastured, the plants put out many branches, and the number of heads and consequently the seed crop may be very greatly increased. On poor, dry soils it is not advisable to pasture before a seed crop, as, if the season should turn dry, the plants will not recover enough to make a profitable crop of seed.

A field seeded to alsike clover and timothy may be pastured advantageously in the spring if the land is rich. Under such conditions the alsike clover makes such rapid growth that it smothers out the timothy. In the North if the field is pastured from the middle of April through the first week in May the alsike clover will be held back until the timothy has made a start, and after this the two come on more evenly and the timothy supports the clover. After haying, the aftermath may be pastured, but on soils not favorable to alsike clover there will be little of this plant left after haying. On good soil, however, there is no lack of aftergrowth.

A farmer in Racine County, Wis., in 1916, cut 100 loads of alsike-clover hay from 35 acres, and in two months after haying the cattle pastured on this field produced cream that sold for a little more than \$400. In Washington a similar practice is followed; the meadows are pastured until May 5 to 10, hay is cut the middle or end of July, and then the fields are pastured again. One farmer in that State pastures three times in one season, closing the field about three weeks between pasturings. When alsike clover and timothy are sown with a grain companion crop there is often good pasturage on the stubble after harvest. If the season is favorable, the clover will stand some pasturing, but this should not be continued too long, as a good growth of the clover is desirable if it is to go through the winter successfully. In sections where the snow is likely to blow it is not advisable to pasture the stubble, because the trampling of the cattle knocks the stubble down and thus lessens the protection the clover will receive from the snow.

ALSIKE CLOVER IN NATURAL MEADOWS.

Alsike clover is often sown on natural meadows, especially when these are wet or can be irrigated. Such meadows are not uncommon in parts of the West and Northwest, and on such lands the clover may either grow with the native grasses or may run them out, making a nearly pure alsike meadow. Methods for getting a stand of clover on these lands differ, but it is usually not necessary to plow. On irrigated land the natural meadow may be disked or harrowed several times with a heavy spike-tooth harrow. The broadcasted seed will start readily after irrigation, and the clover will make a large part of the hay. On sparsely grassed irrigable land alsike-clover seed may even be put in without any working. Plenty of water, enough to keep the ground looking wet, should be given until the plants are well established. After it is well established the clover will endure some drought, but does best with plenty of water. A method successfully used by a farmer in Ottertail County,

Minn., seems to be suitable for use under similar conditions elsewhere. The land is a natural wet meadow, so wet that work must be done before frost is out of the ground and even at harvest time part of the crop must be cut by hand. In the fall, before snow comes, a heavy coat of barnyard manure is put on the land and left just as it comes from the manure spreader until spring. While the ground is still frozen this manure is cut up by dragging a number of times. The seed is then sown, using one part of timothy to two of alsike clover and seeding 8 to 10 pounds of the mixture per acre. This plan has been found to kill the native grasses and to establish a good timothy-clover meadow.

At high altitudes alsike clover does very well. It seems particularly adapted to high, fertile mountain valleys, often coming as a volunteer into the natural meadows and quickly making up the greater part of the hay crop.

ALSIKE CLOVER IN SLOUGHS.

Sloughs and swales are present on many farms and are often waste, unsightly places, covered with marsh grasses and sedges. When such places are not actually swampy, alsike clover can be advantageously introduced and will improve the wild hay or may even run the wild grasses out and occupy the ground. Whenever possible, the wild growth should be killed or somewhat suppressed by pasturing or plowing, but this is not absolutely necessary. The better the conditions are made the more likelihood there is for a successful stand, but if no preparation can be made it is still advisable to take a chance and sow alsike-clover seed among the wild growth in early spring. Burning off the wild growth before seeding is a good plan. Many cases are known where this has resulted in a stand that increased until the alsike clover caused the wild grasses to lodge and finally killed them. In the course of years bluegrass is likely to come in, especially if the drainage is improved, and may in time run out the alsike clover.

ALSIKE CLOVER ON OVERFLOWED LANDS.

Alsike clover is especially vulnerable on wet lands, not only because it will grow best where there is plenty of water, but because it will endure a certain amount of overflow without damage. No definite statements can be made in regard to the length of time alsike clover can be overflowed, especially at different stages of growth, but the experience of bottom-land farmers in widely separated sections has shown that a 1-year-old stand may remain under water for several days, or in winter and early spring even for several weeks, without being killed. More damage is done when the entire plant is covered

than when merely 2 or 3 inches of water stand on the field, but stands of this clover are known to have survived being under 2 feet of water in spring. Sometimes the stand is killed, but the seed that has fallen germinates promptly when the water drains off, and a fair crop is made, or the plants may not be killed, but the crop of hay or of seed for the season may be lost. This ability of alsike clover to live or to thrive on lands liable to overflow several times in a season makes it a plant especially to be recommended for such lands. One farmer in southern Indiana had a stand of alsike clover on bottom land that was flooded for the last three weeks of May, 1918. The clover, which was in bloom, was completely under water for a week. The crop was ruined, but after removing the débris new growth came from the crowns and in May, 1919, there was a perfect stand. When the overflow comes in March or early April the crop has been known to be under water for several weeks without damage.

At the experiment grounds of the United States Department of Agriculture at Arlington, Va., alsike clover was seeded in paraffined wire baskets in June, 1918. These baskets were sunk in large tiles made water-tight and deep enough to allow for 4 inches of water above the rim of the pots. One series was flooded as soon as the seedlings were 2 or 3 inches high, so that the young plants were completely covered. The other series was left under natural conditions. The clover grew in the flooded pots, so that soon the stems and leaves were above water. Part of this series was left continuously flooded from June, 1918, to May 22, 1919, at which time the flooded plants had made very much more growth than those not flooded. (Fig. 7.)

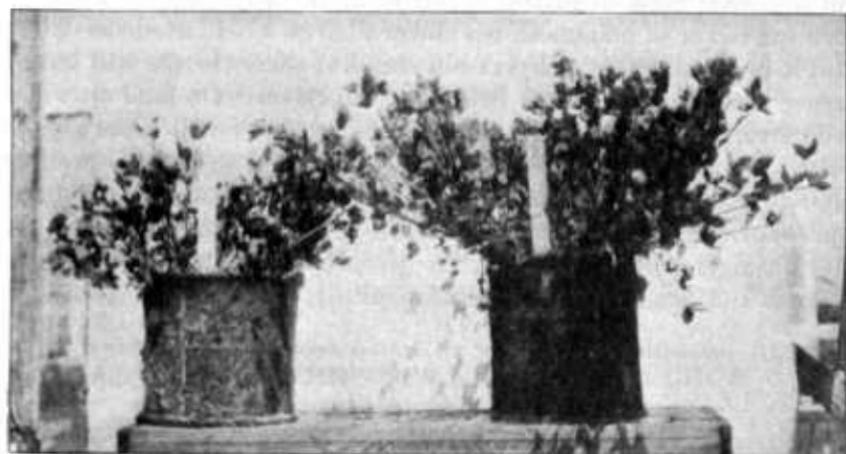


FIG. 7.—Alsike clover will endure much wet. The plant at the right has been growing in a pot completely submerged in water for a year; that at the left grew under normal conditions.

During the winter the water in the tiles was frozen for a part of the time. This experiment shows at least that alsike clover will thrive with the crowns and roots constantly under water. The roots of these plants were abundantly supplied with nodules.

ALSIKE CLOVER FOR ENSILAGE.

Very little use has been made of alsike clover for ensilage. Nevertheless, good silage is made from this clover either alone or with some grass crop or corn. Its use for this purpose is confined to northern Michigan and northern Wisconsin, where the crop is sometimes put into silos. The secret of success in making silage from alsike clover lies in thorough packing. Farmers ensiling alsike clover should have one more man trample it than is necessary in ensiling corn. The crop is put into the silo fresh and moist. If it gets rather dry between the time of cutting and putting it into the silo a stream of water is run on to the cut material. The formation of air pockets must be avoided or spoiling will result.

ALSIKE CLOVER AS A SOIL IMPROVER.

It is commonly supposed that alsike clover is not as good for soil improvement as red clover or, more especially, mammoth clover. No definite data on this subject are available. The Minnesota Agricultural Experiment Station in 1888 published a study of the roots of various clovers. In this study the fact developed that at 5 months of age alsike clover had a greater mass of roots than either red or mammoth clover, and these roots extended to a depth of 4 feet. It is undoubtedly true, however, that after a crop of hay or of seed has been cut a greater mass of matter is left to be turned under on a field of medium red or of mammoth red clover than on a field of alsike clover, and it is possible that a 2-year-old stand of these clovers will have a larger mass of roots than a field of alsike clover. On land on which red clover will not do well, however, alsike clover will make a satisfactory soil-improving crop. It has been used to bring up run-down lands when other crops failed. The number of pounds of nitrogen, phosphoric acid, and potash contained in 1,000 pounds of green red and alsike clovers, respectively, as given by Henry and Morrison in "Feeds and Feeding" (16th edition, 1916), are shown in Table III.

TABLE III.—Quantities of nitrogen, phosphoric acid, and potash found in 1,000 pounds of green clover.

Kind of clover.	Nitrogen.	Phosphoric acid.	Potash.
Alsike clover.....	6.6	1.8	9.2
Red clover.....	6.6	1.3	5.6

From this table it would appear that the tops of alsike clover contain per unit weight quite as much of the three chief fertilizing constituents as does red clover. From the experience of farmers in Minnesota, Wisconsin, Pennsylvania, and Michigan alsike clover may be confidently recommended as a soil improver on land where red or mammoth clover will not catch. Run-down land may be brought up by the use of this clover as well as by red clover.

SECOND CROP OF ALSIKE CLOVER.

In most cases alsike clover does not make a second growth worth cutting. This is true as this clover is generally used, though not the case in all situations and under all conditions. On river-bottom lands and on moist, rich lands in the North two crops are not infrequently secured, especially if the first crop is cut rather early, when just coming into bloom. A few days' delay here may result in the loss of the second crop. In southern Indiana a certain field of alsike clover was cut for hay three times within 120 days from seeding. The second year this field yielded two cuttings, producing in all nearly 5 tons per acre. Another field which the writer saw was seeded about the middle of March, 1917, and late in June the clover was $3\frac{1}{2}$ feet high, nearly in full bloom, and ready to cut. In many sections, too, there is a fair second growth for pasture, but it is true that when mixed with red clover and timothy on run-down lands there will be only one crop and the second growth will not be enough even for pasturing. This is the one great objection to alsike clover and is the chief reason for the lighter yields of alsike than of red clover. When a second growth is made the need for winter protection should not be lost sight of in determining whether or not to cut the crop. Clover is more likely to live through a hard winter when it has 4 to 6 inches of growth than when it has been cut close in the fall and has not had a chance to make a new growth. Therefore, it should not be cut or pastured so late that it can not make at least 4 inches of growth before winter. Because alsike will not grow as fast as red clover at the end of the summer, the last cutting, if made, should not be as late as red clover would be cut, or if pastured the stock should be taken off earlier than would need to be done with red clover.

ALSIKE CLOVER AS A VOLUNTEER CROP

In many States alsike clover is especially valued for its habit of voluntarily reseeding the ground. If the soil conditions are favorable, it will come back in a field for many years. Farmers in the States of Arkansas, Kentucky, Michigan, Minnesota, and Colorado

have for years practiced rotations in which the only clover crop is the volunteer alsike from an original seeding made in some cases as much as 20 years before. These rotations include corn, oats, wheat, and alsike clover, the last volunteering in the wheat and affording a seed crop. Enough seed shatters to reseed the ground and the rotation is resumed. Or the clover may simply alternate with a grain, such as wheat and clover or barley and clover. Or there may be two years of cultivated crops followed by two years of alsike clover. In Colorado a rotation of three grain crops followed by two years of alsike clover is sometimes practiced.

This habit of volunteering is due largely to the fact, as already explained, that the lower heads of alsike clover ripen while the end of the shoot is still growing and blooming and the ripe pods fall off readily when the hay or seed crop is harvested. Where conditions are favorable alsike clover will work into all parts of a farm from a small start. This is especially true if seed is harvested and may, indeed, be an undesirable feature in some sections where white-clover seed is also produced. The seeds of white and of alsike clover are so nearly alike in size that when once mixed they can never be separated. Therefore, as the alsike clover works itself into a white-clover seed section, the production of white-clover seed has to be abandoned, because it can no longer be harvested free from seed of alsike clover.

When alsike clover is fed, the manure always carries a large quantity of seed, and enough clover may volunteer in fields where the manure is spread to make a good seeding. In the West, lands are sometimes seeded from the seed carried down by irrigation water. Where conditions are right this clover will make its way into new territory, spreading from field to field, being, in fact, as one correspondent expressed it, "the only good thing to spread like a weed."

DISEASES AND INSECT ENEMIES.

Alsike clover is not seriously, if at all, affected with diseases such as trouble red clover. Most of them have not even been recorded as found on alsike clover. An undescribed species of anthracnose has been reported, but in Tennessee this clover seems immune to the disease that wrecked the red-clover plantings in certain sections of that State.

A similar statement may be made in regard to insects. Alsike clover is little troubled by the root borer, which is a serious enemy of red clover in New York and Oregon and is more or less prevalent in many parts of the United States. In Idaho the clover aphids give some trouble, but these pests may be destroyed by close spring grazing of infested fields. A field of alsike clover in Idaho was

badly infested in May. It was kept grazed to the ground from that time until June 19, when the field was irrigated and the clover allowed to grow. In August there was a splendid stand, free from aphids, in full bloom. The general statement may be made that, except for the aphids in Idaho, there are no serious insect enemies and that no diseases at present known menace the growth of alsike clover.

SOME HARMFUL EFFECTS OF ALSIKE CLOVER.

As common with other clovers, alsike clover will cause bloat if stock are allowed to eat freely of the fresh plants, especially early in the season. This fact is so well recognized and the proper precautions are so well known as not to require extended discussion. There is, however, another injurious effect that seems largely, if not wholly, confined to alsike clover. This is the disease called trifoliosis by European authorities and mentioned by the Tennessee Agricultural Experiment Station in its Bulletin, vol. 8, No. 3 (1905). While this disease is not well understood, there is sufficient evidence to warrant the statement that under certain conditions alsike clover may cause sores on horses and mules. The statement is frequently made by farmers that this is especially troublesome with white-faced or white-footed horses, and some include white hogs in this class. The trouble, so far as reported, seems not to be general but to be very widespread. From Wisconsin and New York, where alsike clover is largely grown, no reports have been received. Pending further study by the experts of the United States Department of Agriculture no additional statement in regard to this matter can be made. It is well, however, for farmers pasturing stock on alsike clover to watch for signs of sore mouths or sore spots on the fore legs or body. When such are noted the animals should at once be taken from alsike-clover pastures and put on grass. Unless the disease has progressed too far they will promptly recover.

SEED PRODUCTION.

Alsike-clover seed is produced more or less throughout the Northern States as far west as Kansas and the Dakotas and in Idaho. In New England and in Pennsylvania the production amounts to practically nothing. In Maryland seed, so far as known, is produced in but one county. (Fig. 8.) The chief areas of production are western New York, northwestern Ohio, Indiana, southern Michigan, Wisconsin, Idaho, and Oregon. Smaller quantities are also harvested in Iowa, Minnesota, and Illinois. Large quantities are produced in Canada. There are, unfortunately, no data on which to base an estimate of the quantity of seed raised, but the relative importance

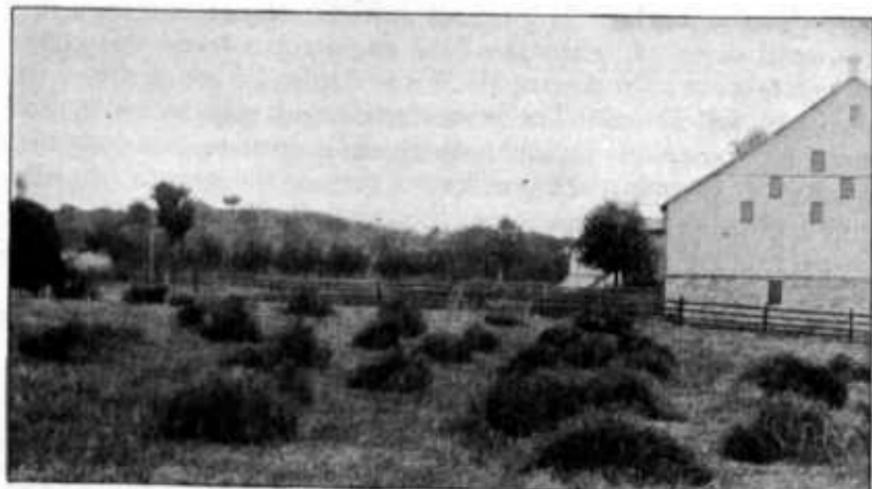


FIG. 8.—Harvesting alsike clover for hay and seed in Washington County, Md.

of the different sections as producers of alsike-clover seed is about as given above. During the past few years Idaho has come to be an important producer, much alsike clover being grown there for seed alone. The seed is taken from the first crop, which ripens some time in July or later, depending on the season, latitude, and method of handling. In some cases fields are pastured in the early part of the season, say until late May or early June. This delays maturity and the seed crop is ready to cut in August. Owing to its irregular flowering habit there will be overripe heads and buds on the same plant. Some of the older seeds will necessarily be lost, but cutting should be done when the largest number of heads can be saved, which usually will be when about three-fourths of the heads are ripe. Cutting is best done with a self-rake reaper, that the cut clover may be left in small bunches. Some take off every other rake. If the growth is rank and much tangled a mower should be used, the cutting being done in the early morning when the dew is on, and men should follow the mower to put the cut clover out of the way of the horses on the next round. Some attach a metal or canvas shallow box to the rear of the cutter bar. A man follows the mower, and as the box fills he rakes the clover off into small bunches. A buncher attachment or swather is also used. Alsike-clover seed shatters readily and great care should be taken in handling it. As soon as dry the clover should be stacked unless it can be thrashed direct from the field. In this case canvas should be laid on the wagon bottoms, so as to catch the shattered seed.

An average yield of 3 to 4 bushels per acre may be expected. Much higher yields have been recorded, 6 to 8 bushels being not infrequently secured, and reports from Idaho claiming yields of

9 to 16 bushels per acre have been received. There is no doubt that under Idaho conditions the yields are materially higher than they are in the East.

When sown for a seed crop in the East the planting should be made on the poorer lands. On rich, low land the growth is rank but the yield of seed relatively small. On the higher or poorer land the clover will be short, but the flower heads more numerous. When the growth promises to be rank and a seed crop is wanted the field may be pastured until about June 1. This will cause many additional shoots to start, each of which will bear flower heads and thus increase the yield of seed. In Idaho seed is grown on irrigated land. There information as to the number of irrigations or as to the best time to stop irrigating is not definite, but the general practice is to water only once in the spring and when one-third in bloom to water more frequently, leaving the water on for 12 hours. This frequent watering is continued until a large part of the heads have turned brown. Alsike-clover seed is also frequently harvested along with timothy seed and the mixture of these is sold as such.

In the East only one seed crop generally is taken from a field before the field is plowed. In some cases, however, from two to four crops have been taken in as many consecutive years. Weeds are, however, liable to get into the field, and it seldom pays to leave it for seed more than one year. In Idaho it is said that two crops can be profitably cut, and sometimes several. The best practice, however, appears to be to take no more than two consecutive crops. If a field is left longer weeds get into it too badly.

Some farmers cut alsike clover for seed as early as possible. This leaves many blossoms and buds, and while the seed crop is perhaps not as large as if the field had been cut later the straw makes good hay. Alsike-clover straw makes fair feed, however, even when the crop is not cut until it is too old for good hay. This straw serves as winter feed for sheep, colts, and young cattle.